Army Enterprise Integration Oversight Office (AEIOO)

http://www.army.mil/aeioo/

RFI Review – Enterprise Application Integration

February 10, 2004

Revisions

Revision	Date	Name	Description
2.0	11-6-03	Ralph Hoffman	Additional comments on EAI vendors
3.0	11-17-03	Ed Loewen	Editorial comments, structure and detail
4.0	11-28-03	Ralph Hoffman	
5.0	12-23-03	C von Bernewitz	
Final	02-09-04	Carla von Bernewitz	Additional Edits

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1.0 Executive Summary

This is a review of the responses from 23 vendors (see Section 4, Table 1) to the AEIOO Request for Information (RFI) Sources Sought for Enterprise Application Integration (EAI) tools (Sources Sought Notice; solicitation number EAIT posted on August 27, 2003 under classification code 70 – general purpose information technology equipment FBO #0636).

Given a lower than anticipated response rate from many of the leading vendors, we also provide our point of view of the current EAI environment and a supplementary review of those other major providers that did not respond to the RFI. This allows the reader to gain an understanding of what EAI is, how it is used, and how it can benefit the Army.

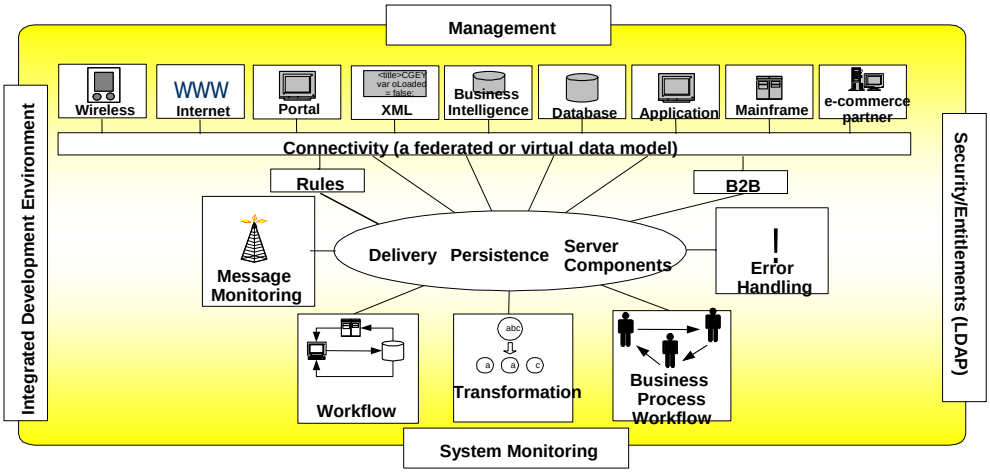
As companies become involved in more advanced enterprise integration initiatives and continue to add new technologies to their enterprise networks, they face the daunting task of interconnecting a wide array of disparate information technology (IT) systems. Traditionally, systems were connected on a point-to-point basis as organizations developed customized integrations according to their needs. As the number of systems grew, however, such integration became more complex and difficult to manage. Without a scalable approach to integration, many organizations found their IT infrastructures were becoming increasingly difficult to manage, impeding the implementation of new technologies.

EAI tools were developed to address these integration problems. With EAI, disparate systems are connected to a single integration server using a repeatable process. Adding a new technology or system is then just a matter of repeating the integration process and connecting the technology or system to the integration server. In this way, all the applications within an enterprise can communicate and exchange data as needed through the integration server, rather than through customized application-to-application integrations.

We recognize the value of reaching beyond the bounds of “connectedness” and instead encourage the ability to “communicate and integrate” externally with all pertinent groups. The internet is an extension of the internal business processes of an enterprise to communities of interest throughout the “connect value chain” using a common language as the means of communication and the method of efficient, integrated trade.

EAI products have reached far beyond their original target of application-to-application (A2A) integration and have been extended beyond the firewalls of the enterprise to extend business process integration to the well-connected enterprise. It is especially in this arena of Enterprise-to-Enterprise process integration that we believe that the trading entity can benefit most through integration in the many facets of business operations. Striving for “zero-latency” supply chains or optimized interactions with suppliers and employees are direct targets for deployment of these tools.

Enterprise Integration uses emerging EAI technologies, web services, legacy transformation services and eData services to solve business problems by integrating heterogeneous systems and automating workflow. The graphic below represents a view of the types of services, applications, and connections typically found in the functionality within EAI tools.



As the title suggests, EAI is about integrating (sharing data and business processes) usually among a variety of key IT applications. EAI may be as simple as passing data between two batch systems at night (middleware), or may be as complex as hundreds of continuous real-time exchanges of inventory data between external vendors point of sale (POS) system's and a manufacturer's supply chain and all systems in between, globally, with electronic workflow and system monitoring.

EAI grew out of the need to transform the complex web of IT processing from the following complex cluster of applications to a more structured, streamlined, logically integrated view as shown below in Figure 1.

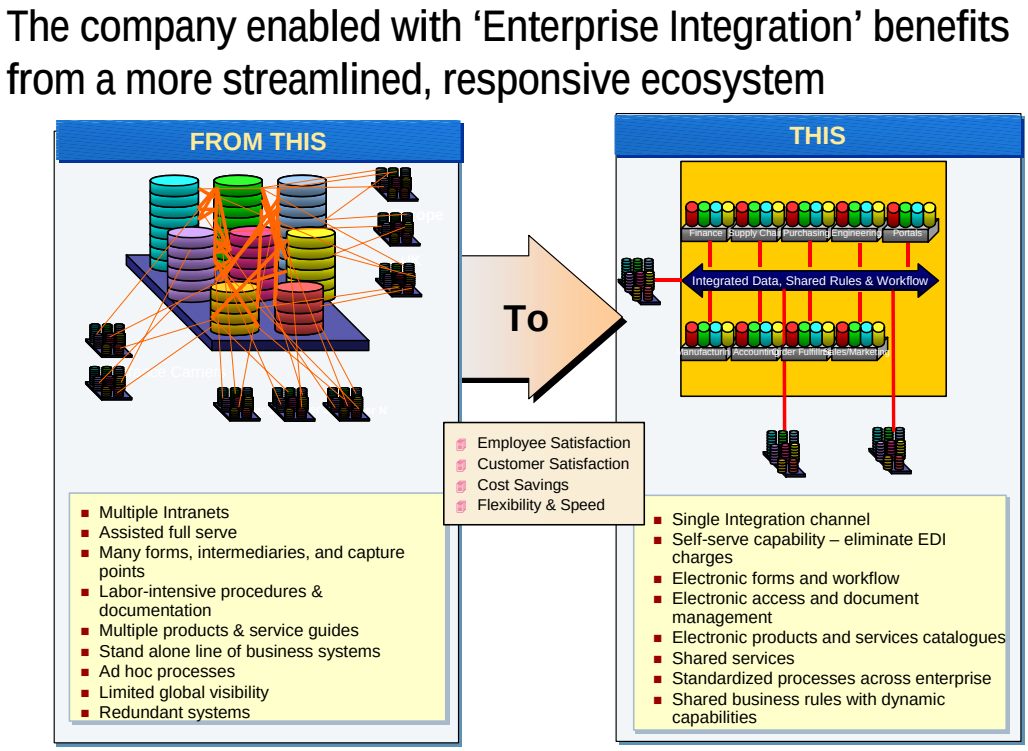


Figure 1: EAI Progression

However, EAI isn't simply about providing better access to data, making your IT infrastructure more reliable, and reducing IT-support workload. As a process, it aims to increase your return on investment(ROI) in your current infrastructure. To understand this, consider how the IT industry has changed its approach to integration over the years. It happened in three distinct stages:

Point-to-Point integration	Middleware-Centric Integration	Process-Centric Integration
Systems are integrated individually by building one-to-one connections. It's a slow, expensive process because connections can't be re-used, and has typically been abandoned in favor of Middleware-centric integration.	A single set of interfaces connects all systems. This approach means your connections are re-usable, robust and scalable, but business processes still tend to be distributed across multiple applications. So while this approach increases the flexibility of an IT infrastructure, it can't provide true integration.	Here, integration is organized around business processes enabling the IT infrastructure to support the realization of new business benefits, such as reduced business time. The process management tools allow the IT department to quickly respond to user requests, while building a portfolio of re-usable processes and connectors, so progressively driving down the cost of change.

2.0 Introduction

We have reviewed the responses to the AEIOO Request for Information (Sources Sought) for EAI tools, and provide the following summary of the responses as well as our point of view of the current EAI environment. This report contains a detailed review of the major EAI tools: IBM, SAP, Oracle, Tibco, webMethods, SeeBeyond, Sybase and other niche providers (BEA, EMSoultions, Integic, Modulant, Oracle, SAP, Sybase, and Vitria).

In addition to assessing the responses and the current EAI landscape, it is important for AEIOO and other stakeholders to have a fundamental and common understanding of EAI, its uses, benefits, and a summary of the key functionality provided by EAI providers.

This document is intended to provide the reader a high-level synopsis of the leading EAI tools available on the market even if they did not respond to the RFI. The reader should not consider this the definitive answer regarding EAI use, nor should it be the sole tool used in deciding the appropriate EAI package. However, it is intended to serve as a facilitating tool to support the decision-making process.

A future upgrade to this document will be to create a list of all EAI tools and modules being used throughout the Army. This information will be made available through our web page by the end of Q2 2004: http://www.army.mil/aeioo/

3.0 What is EAI?

Enterprise Application Integration (EAI) facilitates the integration and moving of data between legacy applications, databases, client-server systems, external company systems and the Intranet/Internet/Extranet. EAI allows for ease of translation of data structures, for intelligent routing of messages and for creation of vital business processes. It becomes critical when integration of existing systems and applications is mandated, the environment for applications is global, decentralized, and heterogeneous in nature, new applications are being developed, best-of-breed solutions must be integrated, and/or information must be delivered reliably.

The primary mission of EAI is to link business processes across packaged enterprise resource planning (ERP), customer relationship management (CRM), Supply Chain Management (SCM), host-based legacy and e-commerce systems. EAI development frameworks define the enterprise integration processes. This reduces the amount of resources required to maintain, develop, and scale systems, as well as allows for the adoption and usage of standards bodies and schema repositories that define business process interaction.

3.1 EAI Component Summary

EAI is not simply data extraction and data exchange. EAI is composed of many services that must be provided to regulate, monitor and transform the data as it crosses from one platform to another (or others). The following diagram illustrates the EAI framework, or service components that make up EAI.

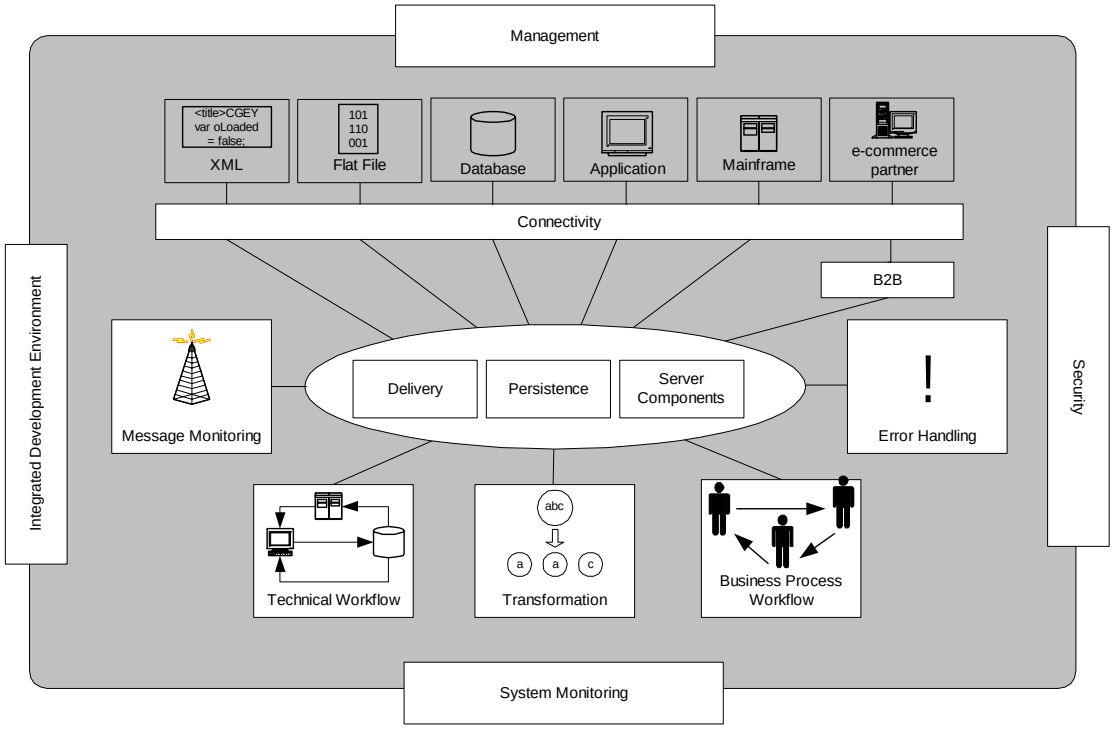


Figure 2: EAI Components

Essentially, this framework consists of the following components:

Core Messaging	Messaging Infrastructure	Supporting Services
Delivery	Rules & Transformation	Systems Management
Connectivity	Technical Workflow	Message Monitoring
Persistence	Business Process Workflow	Systems Monitoring
Security	Error Handling	Business-to- Business (B2B) Architecture

A more detailed review of components is discussed in section 8.0 EAI Component Description.

EAI technology is increasingly used to bring systems into a common enterprise framework without having to modernize all legacy systems and data. EAI technology helps enterprises to monitor their business and to respond quickly to changing business conditions. Additionally, EAI allows IT executives to strategically plan for future integration enabling flexibility and cost-efficiency by maximizing reuse and leveraging existing frameworks.

3.2 EAI High-Level Architecture

Traditionally, systems integration took the form of *one-to-one connections*. A company looking to connect two systems together would develop an interface that would allow the two systems to talk to each other (and only each other). This approach allowed systems to be connected on an as needed basis and was a fairly inexpensive method. There was no additional software that needed to be purchased in order to facilitate the connection. However, each new system that was added would need to have interfaces built between it and any other systems with which it would need to communicate. These custom connections were not very flexible, and only allowed the systems to transfer data that was predefined in the interface. (DoD currently refers to these as IERs- Information Exchange Requirements. For every system there is a requirement to manage each interface.)

The architecture described above can be termed as a point-to-point architecture. EAI solutions primarily use a Hub-and-Spoke architecture, and they are based on a central hub with many spokes (interfaces) attached to it. The hub is flexible, allowing any attached system to communicate with the any other attached system. This model requires the procurement of new software to act as the hub and the construction of new connections to it. The hub and spoke architecture allows the hub to perform functions, such as message queuing, routing and data translation, as well as facilitates real time collaboration and communication between business applications (processes and workflow).

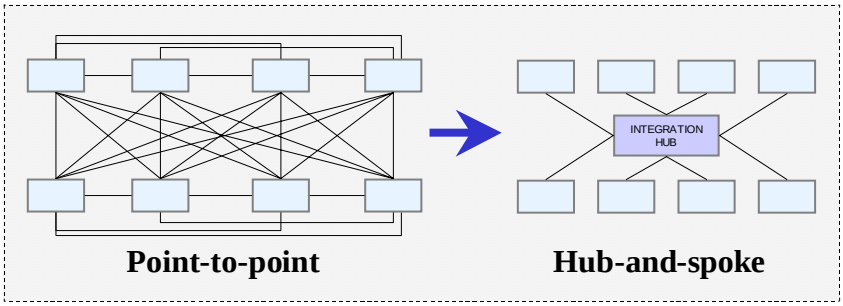


Figure 3: Point-to-Point connectivity vs. Hub-and-Spoke

4.0 RFI Summary

This is a review of the responses from 23 vendors to the AEIOO Request for Information (RFI) Sources Sought for Enterprise Application Integration (EAI) tools (Sources Sought Notice; solicitation number EAIT posted on August 25, 2003 under classification code 70 – general-purpose information technology equipment).

Given a lower than anticipated response rate from many of the leading vendors, we also provide our point of view of the current EAI environment and a supplementary review of those other major providers that did not respond to the RFI. This allows the reader to gain an understanding of what EAI is, how it is used, and how it can benefit the Army.

The responses from 23 vendors (as shown in Table 1 below) have been roughly divided into four categories or types of vendors:

- EAI Software Providers – "Pure-Play"
- System Integrators and resellers
- Research/Analysts
- Other software providers that have partial functionality or complimentary functionality of those pure-play EAI tools (e.g., metadata, data management, modeling tools)

For purposes of this review, most of our effort is focused on the pure-play EAI vendors and how they compare versus one another. The system integrators that responded generally implement the pure-play tools primarily for the government and some commercially. In the case of AMR Research's response, they are willing to sell their advisory services on a subscription basis to the AEIOO, thus providing their unbiased opinions on the market space.

Regarding other software vendors that responded, their core specialties vary wildly from full ERP with EAI functionally embedded (SAP's NetWeaver) to data cleanliness/scrubbing software.

EAI Software Providers	System Integrators Responding	Research / Analysts	Other Software Providers
Emsolve	CACI – Integrator & simulation modeling tools	AMR Research	Actuate –SAP Reporting
Integic	Harris – Reseller		ASG – Metadata tools (Rochade)

EAI Software Providers	System Integrators Responding	Research / Analysts	Other Software Providers
Microsoft	SAIC – Integrator		Cincom – Data integration
Modulant	Software Professional Solutions, Inc. – Integrator & Reseller		DQS – Data cleanliness
Oracle – OAI	Unisys – Integrator & Reseller		ManagedObjects – IT management
SAP –NetWeaver embedded EAI functionality			SAS – Data integration
Sybase			SI International – Architecture Modeling tools
Tibco			Thought, Inc – Data Mapping
webMethods			Valicert -security & file transport & validation

Table 1: AEIOO RFI Response Table

5.0 EAI Marketplace Review

In this section, we provide a general summary of the EAI marketplace then provide a brief summary of the EAI market. While there are several dozen vendors in this software market, the market appears to be maturing and entering into a transitional phase. There will likely be fewer EAI vendors in the next few years, with more of the leading edge technological advances developed by the large providers (e.g. IBM and Microsoft) while capturing greater market share versus the smaller vendors. How well the large ERP vendors (e.g., SAP and Oracle) embed EAI functionality and keep them competitive remains to be seen, but could have significant impacts on the smaller vendors and the future of the EAI space from an Army perspective.

It is important to note that the Gartner Group has identified the five companies that it believes will become the long-term leaders in the integration software space: IBM, Microsoft, SeeBeyond, Tibco, and webMethods, as shown in Figure 4 which is their latest magic quadrant (Q2 2003).

The Gartner research report ranks EAI vendors by leadership position according to vision and ability to execute for vendors in the EAI market space. The magic quadrant evaluation compares completeness of vision along the horizontal axis to the ability of the vendor to execute that vision on the vertical axis. The list of vendors includes smaller firms offering single-solution, best-of-breed products as well as the “pure-play” integration companies – those that focus solely on technology used for application integration. Also included in the ranking are those large multi-dimensional IT services and software companies that are emerging as key players in this maturing market. (e.g., IBM, Microsoft). From a market share perspective, a 2003 Buckingham Research Group study of pure-play EAI vendors showed that Tibco was the leader with close to 38% of the market, webMethods next with 29%, SeeBeyond third at 16%, Vitria fourth at 8.6%, followed by Mercator at fifth with 8.4% of the EAI market.

Figure 4: Gartner Magic Quadrant

While Gartner lists the top five leaders, there are those analysts who believe the large ERP vendors (e.g., SAP & Oracle) will eventually fully build the core functionality offered by those leading vendors, or buy a vendor and embed those components as complimentary offerings to their applications thus reducing the necessity to purchase EAI tools. Regardless, an organization should evaluate ERP integration functionality prior to making that decision.

Perhaps, the first major sign of this change in the ERP space was Siebel's vendor-neutral development of its universal application network (UAN), then SAP's announcement of NetWeaver XI and the emergence of Oracle's integration technology within its application server solution. Application vendors have recognized that all of the return of investment (ROI) claims that they have been making since the mid 1990's could not be fulfilled without a well-defined integration solution, which managed all the interactions between their solutions and the rest of the client landscape.

While ramp-up of the UAN solutions has been slower than Siebel would have wished, these solutions are gaining momentum. If we consider SAP clients who upgrade to version 4.7 of the core R/3 solutions – then de facto they will have, and be running NetWeaver XI (if only for integration between SAP components). Oracle customers too, will be in a similar position as they upgrade to newer releases of the application suite. The consequence of this is that more enlightened customers who have already invested in integration solutions will now have to run at least two sets of products, managing and developing the integrations they require in an even more complex world.

6.0 EAI Vendor Review

This section reviews the five leading pure-play EAI vendors: IBM, Microsoft, SeeBeyond, TIBCO, and webMethods. Publicly available information and other research data are considered in this review as well as that information received in response to this RFI. Following this discussion, a high-level review of the next tier of ERP vendors, market visionaries, and niche players is presented if that provider responded to the RFI, or if they are currently considered one of the top vendors.

The initial descriptions of the vendor components have been adapted directly from their various marketing materials and should be considered biased to that vendor. However, the second section of the tool review, titled comments, provides a more unbiased review of the product as it pertains to our experience. The vendor's website hyperlink is also provided for the reader to visit the site for additional content and information.

Pure-Play Vendors Reviewed	Other Vendors Reviewed
IBM	BEA Systems
Microsoft	Integic
SeeBeyond	EMSoftware Solutions, Inc.
TIBCO	Modulant
webMethods	Oracle
	SAP
	Sybase
	Vitria

6.1 Pure-Play EAI Vendors

Website: http://www-306.ibm.com/software/info1/websphere/index.jsp?tab=highlights

Tool Summary

IBM's WebSphere Software Platform was originally the collective name of IBM's Java 2 Platform, Extended Enterprise (J2EE) application server family. The WebSphere trademark now covers most of IBM's middleware and application development offerings. WebSphere MQ, WebSphere MQ Integrator, MQSeries Workflow, Lotus Domino, WebSphere Studio Developer, WebSphere Business Components, WebSphere Commerce Suite, Tivoli Policy Director, and some third-party products are all included in the WebSphere software platform.

Product components include:

- **WebSphere MQ Family** –Technology from the CrossWorlds acquisition together with enhancements to the WebSphere messaging family are part of a plan to establish a comprehensive e-business platform. Initially, the WebSphere MQ products will be bundled with the CrossWorlds Interchange Server, and also will be available as separate products.
    - **WebSphere MQ (formerly MQSeries)** is a basic message-oriented middleware product that provides reliable, one-time-only delivery of information in the form of messages.
    - **WebSphere MQ Integrator** is an integration broker that supplies message transformation and content-based routing using rules.
    - **MQSeries WorkFlow** is a business process manager workflow technology that manages business tasks that can be minutes.
- **WebSphere Adapters** (formerly MQSeries Adapter Offering) completes this offering.
- **WebSphere Application Server Family (WAS)** –IBM's WebSphere family has become one of the most popular J2EE-based application servers. It is widely recognized as a stable and reliable product. Further improvements were implemented in WAS v.5.
- **WebSphere Application Server Express**– is a low-cost application server. The focus of WAS Express is ease of use in terms of installation, development, deployment, and maintenance. WAS Express will not support the full J2EE interfaces, but it will provide a simple programming model based on JSPs, servlets, JavaScript, and Tag Libraries.
- **WebSphere Application Server Enterprise** – WebSphere Application Server Enterprise v.5 extends WAS v.5 with advanced, nonstandard, or pre-standard Enterprise Extensions

Comments

IBM perhaps realized before anyone else, that integration technologies lie at the heart of any Enterprise Architecture – and have been investing in them for many years. They own the de facto messaging standard solution for the past several years (now part of the Websphere stack – the product formerly known as MQ Series). Over the last two or three years they have replaced the NEoN solution (which was bought by Sybase) and built their own MQSI solution – adding (through acquisition) the CrossWorlds stack (now known as Websphere Business Integration or WBI) and most recently through the purchase of Holosofx they have added a powerful process design and simulation tool. This collection of products is not integrated in the most elegant manner – but it offers a breadth and depth of functionality that is hard to beat. IBM will continue to invest heavily to try to make a market in this space and claim it as their own.

- Proven A2A framework delivery with a strong foothold in the Finance sector
- Crossworlds and Holosofx acquisitions strengthen process integration capability
- Questions exist over the internal integration of Websphere suite and lack of significant Crossworlds references (primarily MQ Series)
- IBM currently has a major development project to integrate the various products that make up WebSphere Business Integration (WBI) (i.e., CrossWorlds, Holosofx, MQ Workflow, and MQ Integrator). The result will be a brand new product, which IBM plans to release in early 2004. As part of the consolidation, IBM is also migrating their integration technology to run

on the WebSphere application server, and unifying their tools into an Eclipse-based development environment, called WebSphere Workbench.

Microsoft

Website: http://www.microsoft.com/net/

Tool Summary

To facilitate the communication between disparate applications and platforms Microsoft has re-architected its core development platform to fully support the idea of communication using industry standards. At the heart of Microsoft's EAI strategy is this new development platform called **.NET**. The .NET platform allows communication (security access to data and systems) across heterogeneous systems, natively using standards. Microsoft BizTalk Server provides the broadest coverage of services within the EAI platform. BizTalk Server is supported by the following products and technologies that can be used with it to address additional service requirements:

- Microsoft Host Integration Server
- Microsoft SQL Server™
- Windows core services including:
  - XML Web services
  - Microsoft Data Access Components (MDAC) data connectivity services
  - COM+ application services

In addition to the products and services, Microsoft also has released a new version of Visual Studio, which is a development tool that automates the process of creating web services based upon industry standards. The Microsoft EAI technologies are based on standards, provide multiple levels of users the ability to use wizards and other familiar navigational tools, and do not require to "rip and replace" existing systems but rather leverage the current infrastructure.

Comments

Microsoft has been investing heavily and has a competitive product offering. Their offerings are particularly relevant for organization's that are looking to build some of their own solutions using either .Net or J2EE standards. Microsoft's BizTalk 2004 – soon to be on general release appears to be the first Microsoft integration solution that is enterprise-ready. They have already delivered some pilot solutions using this technology and initial reviews indicate that this is going to be a very competitive offering.

"…Microsoft's strategy over the years had been to offer a single operating platform to meet requirements of the entire spectrum of business applications, from three-user to 30,000-user deployments. This strategy inevitably led to compromises in the design and positioning of its technology.

…Its potential enterprise customers have been skeptical about the ability of Windows application infrastructure to sufficiently support high-end enterprise requirements on a platform that is widely deployed for relatively small and undemanding applications.

…The .NET vision of loosely coupled service-oriented architecture is in-line with the best practices of systems design and does offer a compelling technology strategy. However .NET architecture is incomplete. Little attention is paid in the .NET vision to application integration or multi-channel portal functionality…." [1]

Website: http://www.seebeyond.com/

Tool Summary

SeeBeyond (formerly STC) began development of its first commercial EAI broker in 1989 with the first sale and deployment of e*Gate™ (formerly "DataGate") occurring in 1991. The SeeBeyond ICAN 5.0 product suite is built upon the core product eGate, which is a J2EE, based integration server coupled with java message service (JMS) based messaging server. e*Gate™ Integrator is an enterprise application integration tool that is intended to act as an information broker between various applications. Other products in the suite are:

- **eInsight Business Process Manager** – for orchestration of services with BPEL4WS support
- **eVision Studio** - for creation of end user interactive web pages
- **ePortal Composer** - to enable enterprise-wide access to business processes from a single point of entry
- **eTL Integrator** – for high volume extraction, transformation and load of tabular data sets
- **eXchange Integrator** – for eBusiness protocol support, trading partner management and secure eBusiness communications
- **eXpressway Integrator** – for software distribution to business partners using onramps
- **eView Studio** – for creating enterprise wide master indexes
- **eBAM Studio** – for generating dashboard to monitor key performance indicators (KPIs) based on data collected through eInsight or eGate.

Comments

SeeBeyond is consistently regarded as the EAI vendor everyone wants to beat and have won numerous awards & recognitions over the years, including Meta Group placing them as a leader in the EAI market.

SeeBeyond is enjoying a well-deserved period of growth and accolade for their EAI and B2Bi offerings. They have gradually worked their way into the leadership crowd and look certain to stay there for some time yet. They are consistently seen as the thought leader within the Application Integration arena, always laying down new technological challenges for the competition. Their product offering also offers a rarely seen, tightly coupled and complimentary suite of powerful integration tools. The toolkits are flexible to either offer an easy to use, wizard based approach, or a more flexible Java based development/extension environment. Although seen as leaders within the

[1] Enterprise Application Integration (EAI) Tools Response for Army Enterprise Application Integration Oversight Office (AEIOO), Technical Discussion, SAIC, September 25, 2003

Healthcare industry, SeeBeyond now has many more feathers in their cap including a good coverage of most industry sectors.[2]

Some additional comments regarding their product include

- Non-proprietary, standards-based, business-process model driven integration platform (J2EE certified)
- Web services-based development and deployment architecture
- Integrated work flow, business process flow and business activity monitoring
- Web-based application monitoring environment
- Most comprehensive offering from a pure-play EAI vendor
- Common repository, development and monitoring tools across the product suite.
- Increased learning curve to get acclimatized to the new version GUI environment
- Not all adapters are available for ICAN5.x
- Software is not cluster aware; relies upon operating system clustering
- Knowledge of Java is a must; however, productivity gain is questionable for Java developer using the 'drag and drop' GUI
- Lack of seamless integration with 3rd Party Version Control tools

To summarize, SeeBeyond is a clear leader in the application integration market, and offers a powerful, flexible and extensible product suite that is proven in many industry sectors. They have proven scalability and have been recognised for their technological achievements through an array of awards and successful customer projects.

TIBCO
The Power of Now™

Website: http://www.tibco.com/

Tool Summary

TIBCO Software Inc. is a leading provider of real-time e-business infrastructure software. TIBCO's three product lines-TIBCO ActiveEnterprise®, TIBCO ActiveExchange™ and TIBCO ActivePortal™-enable businesses to integrate enterprise applications, interact with other businesses in B2B commerce, and efficiently deliver personalized information through enterprise portals. TIBCO's products enable the real-time distribution of information through patented technology called The Information Bus®, or TIB®.

TIB technology was first used to digitize Wall Street and has since been adopted in diverse industries including telecommunications, electronic commerce, manufacturing and energy. TIBCO's global client base includes more than 1,000 customers from around the world such as Cisco Systems, Bell South, Yahoo!, NASDAQ, Ariba, NEC, 3Com, Sun Microsystems, SAP, Philips, AT&T, AOL/Netscape, Motorola, Netscape, Enron, Alta Vista, Enron, and phone.com.

[2] "Adaptive Infrastructure - EAI Point of View," CAP GEMINI ERNST & YOUNG Internal Documents, 2001, 2002, 2003

Comments

Selected highlights of TIBCO's product performance and offering includes:

- One of the few EAI vendors who have a relatively complete EAI toolkit
- Message Broker and Integration Manager are both extremely new to market, and have a tendency to lack flexibility
- TIBCO's adapters frequently are not of production quality and require additional support to run smoothly[3]
- TIBCO Hawk can fill the Message Monitoring functionality, however this does not come out of the box as a standard solution
- TIBCO Professional Services Group has historically been stretched to capacity
- The TIBCO architecture is very flexible. However, because TIBCO uses a broadcast publish/subscribe, troubleshooting failure of the interface can be more complicated than hub & spoke architectures. This means that message monitoring is important. Though Hawk can be configured to support this requirement, this capability must be built specifically for our clients.
- The inclusion of Hawk as a System Monitoring tool is a differentiator in this market. Although Hawk cannot compete with tools like BMC or Tivoli, it does provide a base level of functionality. Hawk has been integrated with Tivoli and this integration is supported by TIBCO.
- TIBCO Rendezvous is a very scalable system. It lacks a single point of failure for message delivery. As TIBCO components are distributed to each system, it cannot be brought down by a single system failure.
- Message Broker and Integration manager are centralized components. While this may affect performance, we recommend using this centralized functionality.
- Extremely fast publish & subscribe capability within Rendezvous
- Vendor stability and number of years in EAI market
- Ability to go beyond system-integration and support data availability to the entire enterprise. TIBCO supports getting data to users desktops. This is very unique in the EAI world.
- Message Broker and Integration Manager products are not fully-baked
- While there is a framework within Hawk, there is no built-in Error Handling or Message monitoring
- Perceived as having a high upfront cost to procure their tools

TIBCO Active Enterprise is one of the premier enterprise integration toolsets and supports a wide array of integration functionality. As TIBCO has been available for over 10 years, they also have expertise in many markets, including health-care, financial, energy, telecom, and retail.

Of all of the EAI tools, TIBCO has the most flexibility – with the only true plug & play technology to support dynamic registration. It is at its best when used for more than point-to- point integration but when an organization desires to get data out of a source system and make it available to many target

[3] "Adaptive Infrastructure - EAI Point of View," Cap Gemini Ernst & Young, 2003

systems including users desktops. If it is a corporate strategy to make information available to people as well as systems, then TIBCO should be considered.[4]

The integration flexibility comes at a slight cost. An organization, which relies upon TIBCO for integration of applications, may need additional configuration to support guaranteed and transactional messaging. In addition, TIBCO is not typically the lowest-cost EAI provider.

webMethods

Website: http://www.webmethods.com/

Tool Summary

According to webMethods product literature, their Integration Platform has become the standard by which all other integration solutions are judged. It begins with a standards-based, service-oriented architecture that provides the most comprehensive, enterprise-class integration capabilities on the market. A complete set of graphical tools is supplied to help organizations leverage these capabilities without the need for code, simplifying and accelerating the integration process. Next, comes a full portfolio of quality-of-service features and functions to ensure that the integration platform is available and reliable. Finally, there are the authentication and authorization safeguards necessary to secure the integration platform and the systems it integrates. The result is an integration platform built to handle the complex requirements of today's businesses — effectively, reliably and economically.

- **Web Services-** webMethods is an established leader in the adoption of Web services into the integration landscape and was an early pioneer in creating the specifications for Web services. With the webMethods Integration Platform, any business process can be instantly exposed as a Web service, or can call any existing Web service, whether built on webMethods or not. The webMethods Integration Platform complements and extends Web services capabilities by providing what Web services alone do not: security, transactionality and reliable delivery.
- **J2EE and .Net Integration -**J2EE and .Net represent the two prominent architectures for the development of new applications. Many integration solutions allow access to one of these architectures, but not both. However, most organizations will likely have both architectures in-house, therefore creating the need for integrations that span not only J2EE and .Net, but also legacy applications — all in one operation. As a result, webMethods is an effective integration solution, bridging the application development environments with all of the IT assets in the enterprise. This removes any barriers to building the composite applications that represent today's complex business processes.
- **Legacy Access -** In spite of predictions of its imminent demise, the mainframe and the legacy data that resides on the mainframe still form an important component in the IT portfolio of many organizations. The ability to access this information and integrate it effectively with other IT assets is an important factor to successfully integrating the enterprise. The webMethods Integration Platform allows integration of mainframe and legacy applications without the limitations and drawbacks of traditional mainframe integration approaches. Through the webMethods Mainframe component, organizations can include applications running under CICS or IMS/TM on IBM compatible mainframe computers in their

[4] Ibid

integration solution. They can also Web service enable legacy systems. All of this is accomplished with a unique, non-invasive approach that effectively reaches the information needed without having to install software or code on the mainframe itself.

- **Trading Partners** -The webMethods Integration Platform presents a unified solution for rapidly adding trading partners and managing their interactions. It takes integration beyond the internal organization and extends business processes over the Internet to create integrated value chains. It provides collaborative tools to simplify creating, securing and managing trading partner agreements. As a result, these customers and partners can very quickly become tightly integrated with the supply chain or marketplace initiatives of the host organization, increasing collaboration and creating efficiencies that drive real value to the enterprise. Trading partner integration is yet another area where webMethods is a leader in standards-based integration, supporting established and emerging e-business and industry standards such as RosettaNet, ebXML, UCCNet, CIDX, Chem eStandards, SWIFT, FIX, EDIINT, AS1 and AS2.
- **Adapters -** webMethods provides a broad number of adapters to provide unmatched access to all the information sources possible in today's extended enterprise. This includes adapters for packaged, legacy and custom applications. These standards-based adapters allow for rapid integration of heterogeneous systems, providing fast, efficient access to your important information sources and eliminating the need for developers to understand low-level details of individual application interfaces. Adapters are already pre-built for major enterprise applications, databases and data warehouses. Several enterprise applications, including SAP, i2, J.D. Edwards and BroadVision, also embed webMethods technology in their integration infrastructure. For custom applications, there is an adapter development kit for the quick creation of adapters using webMethods' standard framework. webMethods' broad catalog of adapters ensures that all of the data in an organization is within reach.

Comments

webMethods has just announced the acquisition of The Mind Electric (to strengthen their standards-based Services Oriented Architecture support), the Dante Group (to enhance their Business Activity Monitoring capabilities), and DataChannel (from Netegrity … a portal solution). This adds to their bundling of the leading open source application server technology (JBOS).

webMethods announced that it has completed the final stage of its strategic plan to provide customers with a 100 percent standards-based, non-proprietary and vendor neutral solution to run, measure and optimize their business.

At the core of the announcement is the introduction of webMethods Fabric™, a 100 percent standards-based solution that is, unlike proprietary integration and application server products available today, capable of universally linking all computing resources into a common enterprise fabric. Key to their approach is the ability of customers to incorporate all their current resources including packaged applications, the webMethods Integration Platform, proprietary integration products from other vendors, as well as the new generation of service-oriented application modules from the traditional packaged application vendors

- Proven integration framework delivery with strong B2B and supply chain management (SCM) credentials
- Limited Finance sector experience

- Fully integrated process integration capability with strong human interaction components
- The webMethods solution has a long track record in mission-critical deployments and has the benefit of having evolved over several versions.
- webMethods is the only vendor to offer a unified, platform-oriented, solution. webMethods offers unified end-to-end business process modeling (EAI, B2B, and workflow are not treated separately), unified logging and monitoring, shared runtime infrastructure, etc..
- webMethods announced that PeopleSoft and webMethods are collaborating to embed the webMethods Integration Platform into PeopleSoft's AppConnect business integration platform. The expanded solution will enable customers to integrate mission-critical systems and analyze operations in real-time while reducing the time, effort and cost of implementing integration initiatives across the enterprise. The webMethods Integration Platform adds an extremely scalable way to connect business applications and processes from largely distributed, heterogeneous global enterprises. The expanded relationship includes collaborative engineering, demand creation, joint sales and integrated global support for customers

6.2 Other EAI Vendors

Website: http://www.bea.com/framework.jsp?CNT=homepage_main.jsp&FP=/content

Tool Summary

Through a combination venture capital funding, strategic acquisitions, and effective management, BEA Systems has emerged as the largest business online transaction processing (OLTP), and its Tuxedo OLTP Monitor garners more than 60% of non-mainframe TP monitor revenue. Its product offerings include:

- *BEA WebLogic Server*—a Java-only, Sun-certified J2EE 1.3 application server. It also is the underlying technology of most other BEA products.
- *BEA WebLogic Integration*— BEA relies on third-party-supplied adapters and EDI interchange for this product, which also includes its flagship WebLogic Server. WebLogic Integration is pure Java, and integrated with the application server technology by virtue of sharing the common base middleware code.
- *BEA Tuxedo*—the market-leading OLTP monitor is a proven platform for high-end transaction-processing applications, supporting up to several thousand concurrent transactions in a single image.
- *BEA WebLogic Portal*—a recent addition to the BEA product portfolio it is a second-generation portal built around the BEA WebLogic application server.
- *BEA WebLogic Express*—bundled with WebLogic Server or available as a standalone, WebLogic Express is a JDBC adapter set for leading relational database management systems and a thin platform for JSP and Java servlets.

- *BEA WebLogic Enterprise Platform*—is an integrated, e-business, computing platform, including WebLogic Server, Portal, Integration, and Workshop. The Platform is BEA's future entry into the new market of application platform suites.
- *BEA WebLogic Workshop*—is a development toolset that aims to hide complexities of J2EE programming and facilitate easy development of Web-services-based applications.
- *BEA Jrockit JVM*—BEA Jrockit JVM is recently acquired Java virtual machine technology, available for Windows, Solaris, and several other OS platforms.

Comments

- BEA, like IBM and Microsoft, has been investing heavily as well. BEA released version 8 of their WebLogic solution, which includes a robust – J2EE focused integration solution – arguably one of the best infrastructure-based solutions in the market. Started in 1995, BEA has become one of the largest, pure-play middleware companies in the world, offering most aspects of the middleware market.

intēgic

Website: http://www.integic.com/

Integic delivers vertically focused inter-enterprise applications and business-to-business integration (B2Bi) solutions that enable e-commerce and e-communities to transfer business and technology strategies. With more than a decade of experience, Integic prepares clients to take immediate advantage of the Web, streamlining operations and increasing ROI while leveraging new market opportunities. Integic leverages its subject matter expertise and market leading partners to deliver end-to-end solutions. e.POWER®, a major component of the Integic core technology framework is a leading integrating process management engine.

EMSoftware Solutions, Inc.
The Enterprise Management Software Company

Website: http://www.template.com/

EMSolutions, Inc. and EMSoftware Solutions, Inc. are owned under the Enterprise Management Business Holdings (EMBH) umbrella of companies that includes EMSoftware Solutions, EMSolutions, Back Office Solutions, and EMTravel Solutions. Each company has its own specialized products, services, and target customer base. EMSolutions focuses on Government services.

EMSolutions' origins trace to a select core of software, systems engineering and network professionals who began in 1983 to support research and development of classified advanced technologies. EMSolutions was formed in 2000 when three senior members of the organization purchased the entire organization and it's contracts.

Concentrating in software products and services for commercial customers, EMSoftware Solutions recently purchased Level8's Geneva product suite, which was formerly known as Template Software's SNAP®.

SNAP® is an open modular system technology that provides near real-time processing of asynchronous, heterogeneous information in a common operating picture. It is able to integrate data, information, functional applications, and event handling from distributed legacy systems in such a fashion that ensures accurate analysis for decision support, collaboration, modeling and simulation, and real-time data management. SNAP® is a COTS product (currently on Version 8.0) that has a number of Government and commercial applications.

SNAP® is a template for building distributed mission critical applications. The fundamental tenant of SNAP® is that it is a Template. By template they mean that there is an architecture and a set of reusable components that understand the architecture. One does not "build" a SNAP® application. Rather one "completes" the application using a graphic environment.

The heart of SNAP® is an "active object model". The object model displays both goal seeking and event driven behavior. This characteristic differentiates it from platforms such as J2EE or .NET that have passive object models. SNAP® allows an event from the outside world to automatically be passed from process to process, trigger processing, and display results without the need for any special programming.

Surrounding the SNAP® object model are frameworks for: (1) User Interface, (2) Peer to Peer communications, (3) external communications. These frameworks are matched to the object model. SNAP® has over 30 different adapters that allow it to connect to external systems such as mainframes, ERP Systems, and databases. Most relevant to U.S. Army's needs, SNAP® works exceptionally well providing a shared data environment that allows disparate, legacy data sources to connect freely without enterprise architecture constraints.

MODULANT

Website: http://www.modulant.com/

Modulant is an enterprise solution provider focusing on business process interoperability. Long regarded as a cost of doing integration, an organization's ability to manage information has become a strategic advantage. Modulant provides methodologies, tools, and services that enable complex organizations to centrally manage, re-distribute, and employ their decentralized information assets to support critical business processes.

Modulant's offering, Contextia, is the brand name for all associated products, methodologies, and services that assist organizations in managing their information resources. Contextia moves the technology curve from today's meta-data systems. Contextia provides a proven methodology and a set of tools designed specifically for complex, decentralized enterprises.

Modulant's Contextia Product Suite is built on the concept that organizations and the information which is the lifeblood of an organization is dynamic not static.

Modulant has developed the following tools to allow organizations to remain adaptive and thereby enabling changes to business processes and the technologies that support them.

- The Modulant Contextia Interoperability Workbench (CIW) enables users to easily and intuitively discover and capture the meaning, relationships, and context of enterprise information.

- The Contextia Dynamic Mediator (CDM) component is a web services engine that can perform near real-time mediation between a source and target data set.
- The Contextia Connection Serverware (CCS) allows organizations that do not control each other's internal business processes to build business relationships that are secure, loosely coupled, and efficient. The CCS acts as the shipping department for your IT organization.
- The Contextia Business Process Engine (BPE) is a Business Process Management tool for organizations that wish to manage adaptive business processes. Contextia BPE is the application of choice to automate business processes from small work groups to large inter-organizational processes.

ORACLE
SOFTWARE POWERS THE INTERNET

Website http://www.oracle.com/appserver/index.html?content.html

9*i*AS Integration is Oracle's COTS software solution to enable Application, B2B and ASP integration. The solution rationalizes the infrastructure and products across different stovepipe solution stacks and delivers a consistent integration solution. This software delivers and specifies the tools and the infrastructure for integration. Due to the complexity of real world integrations, and the sheer number of (different) end-points in such an integration, Oracle takes the position that integration needs to be meta data driven, not programmed.

InterConnect is a feature of the Oracle 9*i*AS software, which simplifies the design process to create and modify integrations for business processes through the use of a graphical design tool that enables wizard based modeling of the integrations. Analysts can model all aspects of integration, from specifying mappings and transformations to setting-up information flows for the various supply chain processes, including content based routing.

Oracle9*i*AS InterConnect employs a "hub and spoke" architecture that greatly simplifies maintenance, and makes the future addition of new applications much easier. InterConnect's hub and spoke approach provides a central "common view" of business objects and events. This allows users to more readily adopt and use standards, such as the Open Application Group's (OAG) IS application and the B-to-B integration standard, using XML-based Business Object Documents.

Oracle9*i*AS InterConnect integrates the full array of applications in an enterprise, such as open systems packaged applications, proprietary applications, or communications via standard protocols for remote integration to ASPs, exchanges or supply chain partners. Adapters use native interfaces to applications. Adapters also translate application events and business objects into XML messages for delivery and translate from XML upon receipt. Standard adapters shipped with Oracle9*i*AS InterConnect are provided for Oracle Applications, Oracle Database, Oracle AQ, FTP, HTTPS, and IBM MQ Series. Access to non-Oracle data is available through Oracle Transparent Gateways. In addition, an adapter Software Developer's Kit (SDK) is provided for the creation of custom adapters to proprietary applications such as "legacy" OS/390 applications.

Comments

The Oracle Applications Interconnect (OAI) product is an integral part of the Oracle 9iAS application server platform. Oracle does not market or sell OAI as a stand-alone product and does not intend to do so in the near future. We expect Oracle to continue to release it as a tool to integrate other applications with 9iAS. There are currently two stable versions of the OAI product suite, namely the 4.1 and the 9.0.2 versions. Oracle supports both these versions, though there are several features available with the 9.0.2 version is not supported in earlier versions.

While the OAI is an effective tool in integrating legacy applications with the Oracle eBusiness suite, it is clearly not a full-fledged EAI suite.[5] Today's EAI marketplace continues to evolve and morph into web services, business integration and business service orchestration; Oracle's product may not be positioned to survive those trends. However, so long as traditional legacy integration continues to be a huge portion of enterprise integrations OAI might be all the functionality that clients need to integrate two systems.

One major advantage to go with OAI for clients is that the upfront cost for the OAI product is quite low and often included with the eBusiness suite depending upon the licensing structure. Finally, since the database is the central backbone for the OAI product, it provides a very robust and stable system that guarantees messages and failure recovery. This is a huge plus if Oracle decides to enhance the product and market it as a complete EAI suite in the future.

Website: http://www.sap.com/solutions/netweaver/

Tool Summary

On January 16, 2003 SAP announced the formal launch of their NetWeaver Platform. The NetWeaver platform represents the culmination of several years of investment on the part of SAP to develop a new technology platform to increase the openness and extensibility of their solution set. SAP NetWeaver is a comprehensive integration and application platform. NetWeaver is designed to work with existing systems and software. SAP NetWeaver embraces Internet standards such as HTTP, XML, and Web services. Ensuring openness and interoperability with Microsoft .NET and J2EE environments such as IBM WebSphere.

The power of SAP NetWeaver is that it delivers a scalable architecture that supports enterprise solutions across heterogeneous systems and company boundaries. It brings together structured and unstructured information, harmonizing data formerly trapped in multiple systems. With predefined business content to accelerate return on investment.

SAP NetWeaver features predefined business content that eases integration, reduces custom configuration, and accelerates implementation. So you can benefit from rapid return on investment and lower total cost of ownership.

Business content delivered with SAP NetWeaver includes pre-configured portal content and roles to enhance people integration. It offers reports and analysis to improve information integration, as well

[5] "An Evaluation of Oracle Applications Interconnect (OAI) as an EAI tool," Cap Gemini Ernst & Young, September 2003

as interfaces to weave together back-end business processes. Plus, it features self-services, analytical tools, and support -- to enable you to reduce costs, improve sales, and foster collaboration.

SAP NetWeaver provides all the capabilities necessary to develop, integrate, and run solutions following Enterprise Services Architecture. Key capabilities include:

- **Portal infrastructure** -- This capability delivers unified, personalized, and role-based user access to your heterogeneous IT environment. It is provided through SAP Enterprise Portal, a component of the mySAP Enterprise Portal solution.
- **Collaboration** -- Collaboration promotes dynamic communication within permanent and ad hoc teams or communities. It is provided through SAP Enterprise Portal, a component of the mySAP Enterprise Portal solution.
- **Multichannel access** -- With multichannel access, you can connect to enterprise systems through voice, mobile, or radio-frequency technology. It is provided through SAP Mobile Infrastructure, a component of mySAP Mobile Business.
- **Knowledge management** -- Knowledge management provides content management capabilities with integrated search, taxonomy, classification, publishing, and related workflow processes. It is provided through SAP Enterprise Portal, a component of the mySAP Enterprise Portal solution.
- **Business intelligence** -- This capability enables you to integrate, analyze, and disseminate relevant and timely information. It is provided through SAP Business Information Warehouse, a component of mySAP Business Intelligence.
- **Master data management** -- This capability promotes information integrity across a business network in a heterogeneous IT environment. It is provided through SAP Master Data Management.
- **Integration broker** -- This capability enables XML/SOAP-based communication between application components from various sources and vendors. It is delivered through SAP Exchange Infrastructure.
- **Application platform** -- This capability supports platform-independent Web services, Web applications, and development. It also provides complete support for Java technology. It is provided through SAP Web Application Server.
- **Business process management** -- With SAP NetWeaver, you can model and drive processes in a dynamic IT environment. Business process management allows you to combine underlying applications to form adaptive, end-to-end processes.
- **Solution life-cycle management** -- SAP NetWeaver provides comprehensive technology for all stages of the software life cycle, from implementation to operation to continuous improvement. It also includes functionality for:
    - Web application development -- SAP NetWeaver provides an integrated development environment for Java applications and a wide range of tools for developing, testing, and deploying applications.
    - Security -- Security technologies include single sign-on, role-based authorization, central user administration, secure information exchange with encryption, and more.
    - Globalization -- SAP NetWeaver supports global business in multiple languages, currencies, and time zones.

- **Composite application development** -- The composite application framework is the "factory" in which SAP xApps can be built quickly and easily.

Comments

- The combination of NetWeaver and the mySAP Business Suite puts SAP in the unique position of having both the functional and technical capabilities required to enable an Adaptive Enterprise. No other vendor can make this claim.
- NetWeaver is the technology platform (Portals, Business Intelligence, and Exchange Infrastructure) that implements SAP's Enterprise Services Architecture (ESA)
- ESA is SAP's blueprint for complete and services-based solutions
- All SAP business solutions will be based on ESA and NetWeaver
- ESA & NetWeaver are SAP's big bet for the future of their corporation
- SAP has gone to great lengths to ensure interoperability with Microsoft's .NET and IBM's WebSphere platforms and have formed collaborative technology support centers with these partners for development of solution components.
- The introduction of NetWeaver will cause a step change in technology within the SAP ecosystem of over 18,000 customers; by 2005, all SAP customers will need to migrate to this new architecture. An estimated 1500-2000 companies will upgrade in the next 18 months
- SAP Supplier Relationship Management (SRM) and CRM solutions are already based on the new architecture
- 4500 Portals installations have been completed or are in progress. SAP estimates this growing to 18,000 in 2003
- Business Warehouse is the fastest growing business intelligence (BI) solution in the market with over 6000 installations live or in progress
- 1500 web application server installations are expected in 2003
- However, the introduction of NetWeaver adds complexity to the SAP solution set that requires a shift from "software" sales to "solution" sales.

SYBASE

Website: http://www.sybase.com/products/middleware

Sybase delivers open-architecture solutions that provide the data management and mobility necessary to create the unwired enterprise. Sybase solutions integrate platforms, databases, and applications (liquidity), and extend those applications to mobile workers through mobile and Wi-Fi technologies (mobility).

Sybase offers an extensive range of integration solutions, including:

- Sybase BPI Suite, the comprehensive business processes management solution
- Sybase BizTracker™, a complete business activity monitoring tool

- Integration Orchestrator, a cross-enterprise solution to orchestrate applications and processes within and across enterprises
- Adapters, Sybase offers an assortment of prepackaged adapters designed to work with specific off-the-shelf applications and standards.
- EDI Products, Sybase delivers products to leverage and protect investments in EDI while extending systems toward more advanced e-Business capabilities.
- HIPAA Products, Sybase provides a range of solutions for the healthcare industry in addressing HIPAA requirements. Sybase's HIPAA Accelerator, touted as the most complete solution available today, also known as the HIPAA Toolkit, gives healthcare organizations the technology needed to develop and implement HIPAA administrative transactions.
- Integration Servers, Sybase's e-Business integration software was designed to address the needs and challenges of multiple industries Sybase provides three workhorse solutions; e-Biz Integrator™, e-Biz 2000™ and New Era of Networks Integration Package.
- Process Server is an XML-based business process design tool and execution server. New Era of Networks Process Server helps companies integrate new and existing IT systems into a cohesive business process flow that speed response times, improves efficiency and reduces operational costs

Recently, Sybase was rated in the top three by the Butler Group, one of Europe's leading IT research firms.

> *"Sybase's position is well-deserved. The vendor has brought together a range of technologies and capabilities, and forged them into a solution packed with technical credibility and clear focus." -- Butler Group*

VITRIA

Website: http://www.vitria.com/

Founded in 1994, Vitria is a pioneer in the integration market. It has been a leader in bringing new technology to bear on integration– originally through its support of business process management and business activity monitoring. It has incorporated advances in semantic reconciliation and transformation ("Business Vocabulary Management"), metadata management, business activity monitoring (the new Vitria Cockpit), and pre-built integration solutions ("collaborative applications" or collaborations).

Vitria is a leading provider of business process integration (BPI) products and solutions, combines technology leadership with industry expertise in healthcare and insurance, financial services and communications to dramatically improve strategic business processes across systems, people and trading partners. Through pre-built and custom business process integration solutions that preserve and extend a company's existing technology investments, Vitria provides real-time, end-to-end visibility and streamlined control over key business processes and data.

It also developed strong Web services capabilities and support for integrating third-party (IDS Sheer) business process modeling tools with its already-strong native business process management facility. Vitria specializes in real-time, event-driven, process-managed integration. It also addresses more traditional forms of integration involving EDI, files, and mainframe connectivity. It offers more than 100 adapters, some of which are application-specific and technical in nature (e.g., it has 3270, Adabas, CICS, IDMS, and VSAM adapters).

- Vitria's BusinessWare is equally relevant for B2B and intra-enterprise A2A integration scenarios.
- Vitria has five domain-specific integration applications under their Vitria Collaborative Applications(VCA) name: financial markets, manufacturing, utilities, health care/insurance, and VCA for CIM Synchronization (horizontal applications for connecting commonly used enterprise applications such as Oracle, PeopleSoft, SAP, and Siebel) All of these collaborative applications have pre-built business object definitions, transformations, and process definitions that are closer to a complete solution than the features supplied by a traditional integration middleware tool.
- Connector SDK – lets developers build other adapters as needed.

7.0 The EAI Decision

The Gartner Group identifies two models of EAI, opportunistic and systematic. Organizations following the systematic integration route generally are attempting to solve a single issue (i.e., the integration of a few specific systems). Their desire is to support a single effort using the most reliable, easy-to-implement EAI tool. While this approach is valid, some organizations are interested in taking a more opportunistic route, choosing the best EAI tool for long-term gains or selecting a tool that provides up-to-date (cutting edge) functionality. Both approaches are valid, and both may be implemented simultaneously.

EAI is usually not a single product but a combination of multiple products that support enterprise-wide systems integration. Not all organizations need all components of EAI. By the same token, some customers require multiple EAI tools to support their business need. The Army and DoD may very well require more than one tool to support the demands across the dynamic nature of the organization.

The selection of an EAI tool should not only be based upon vendor presentation, but knowledge of the vendor's target market as well as the product supportability, required implementation resources, true scalability and real-world findings should have equal bearing. Consultation with experienced professionals may help the decision-making process.

Shown in the appendix (section 15.1) is an enterprise integration decision chain. This simple graphic can help the potential user of EAI to determine if their program is a good candidate for enterprise integration.

8.0 EAI Component Description

EAI is an extension of the middleware concept, with two obvious benefits. Like traditional middleware it provides a framework for any of your systems to talk to any other, but with an increased focus on reuse of connections. On top of that, EAI adds a new layer of easy-to-use process

management tools. They aim to enable the realization of business integration opportunities through the modeling and implementation of cross business and cross platform workflows. Business users gain the ability to reorganize around new workflows without the infrastructure being a constraint. In addition, the program offices can focus on added value implementation without incurring an ever-increasing maintenance and support load.

There are nine components commonly found in the leading EAI vendors. A general description of each of the EAI components follows.

1. Middleware/Delivery
2. Adapters/Connectivity
3. Rules & Transformation
4. Technical Workflow
5. Business Process Workflow
6. Message Monitoring/Handling
7. System Monitoring
8. Security
9. B2B Integration Architecture

8.1 Middleware/Delivery

Provides a delivery mechanism between adapters and other EAI components. All EAI vendors use some form of middleware – from a hub and spoke message queuing system to a publish and subscribe mechanism. Nearly all EAI vendors on the market provide a competitive middleware product. The marshalling of data from one location to the next can be successfully managed in a reliable and guaranteed method.

The architecture of the middleware, however, should help drive the decision. A true publish and subscribe capability such as that used by TIBCO can provide benefits such as speed and component distribution. However this type of architecture provides additional strain on supportability (distributed components means distributed troubleshooting) and complexity. Middleware that is hub and spoke based simplifies the overall supportability problem, but can lead to data throughput issues and provide a single point of failure.

Generally, all EAI vendors have an approach to resolve their respective issues. The reader should understand, however, that this might mean additional architecture and configuration effort is required prior to implementation.

8.2 Adapters /Connectivity

Adapters are the on and off ramps of the Middleware highway and are used to gain entry and exit from the middleware. They enable systems to put information on to the highway and get information off. Occasionally a middleware-application appears that can communicate directly with middleware without the need for adapters. Adapters can take many forms to cater for the many ways information may need to be accessed – relational databases, flat files, custom file formats, screen scrapes etc. The main purpose of the adapter is to get data connectivity, however it may perform other EAI roles as well, depending on the rest of the

architecture. For instance, some vendors rely on adapters to perform the data conversion process defined in the Rules and Transformation section of this document. This may or may not be a good thing; again, this is dependent on the type of architecture that the customer needs to deploy.

The following is the primary role of adapters:

- Place data on or get data off the Middleware transport layer
- Report errors on data delivery failures
- Report errors on application failures

Optional roles include:

- Reformat the out-going or incoming data
- Perform data integrity checking
- Filters the messages and fields being passed across its interface

When selecting an EAI tool to meet the Army's needs, identify the versions of applications that will be used and request the documentation for the adapter matching that version. Adapter 'vaporware' is a common thread among EAI vendors. Be specific and ask for the documentation for the point release of the business applications you are using. This often makes a significant difference in being able to meet your integration goals.

8.3 Rules & Transformation

The rules and transformation component of an EAI toolkit is designed for performing the data mapping from an originating system to the format of a target system. For instance, if a source system were to store Cust_Name = last name, first name and a destination system requires Cust_Name = first name, last name then the rules and transformation engine would receive Cust_Name, identify that there is a business rule on Cust_Name, read the rule, and then perform the conversion. In this way, rules engines can support conversions such as ASCII to XML.

Most rules and transformation engines are graphical. They allow the user to map data into the new format by using custom controls and pull-down menus. This is very important because while middleware and adapter components require programmers, a good rules and transformation engine can use a technical analyst to perform the conversion.

Most rules engines support multiple formats from fixed to variable to delimited. Rules engines are stateless. This means that they have no idea of the order of processing. They simply take the latest message and act upon it. However, most business processes require that certain steps be followed, this is where a technical workflow component is beneficial.

A lesson we have learned is not to try to use rules and transformation (R&T) engines to support message states. For example, if you were to take a rule which, depending on the data, called another rule, you are then attempting to manage the message state (i.e. order). Most R&T engines allow you to do this; however, not only is it not architecturally sound, it will

most likely cause technical issues with the R&T product. In this case, use a technical workflow component to support message states.

8.4 Technical Workflow

The technical workflow EAI component is used to drive the order of messaging within the EAI tool. For instance, in the Telecom world, a message from the order entry system should most likely first be sent to a provisioning system before it is sent to a billing system – this way a client is not billed for a service that has not been delivered. A technical workflow engine would have the business process identified within it, and would not send the message to billing until it received a positive response from the provisioning system.

Through the use of a technical workflow engine, business rules can change on the fly. Perhaps in the above example a business changes its model and decides to start billing before provisioning. A change in the technical workflow tool can allow this to immediately take place.

We highly recommend the use of both a rules and transformation engine along with a technical workflow engine. Even without using these components, the systems integrator will have to write logic in some location to manage both sets of functionality. However, if the logic is built inside these components, the customer will have the flexibility to update the integration components without updating code.

8.5 Business Process Workflow

Most business transactions require both technical processes as well as human processes. For instance, a financial trade can't be sent to the floor of the stock exchange without it being manually entered on a trading system first. All businesses have some form of human-based workflow that they manage. However, what happens when human and technical workflows intercede?

The automation of a message as identified in technical workflow is only a single part of a business transaction. Using the trading analogy above, assume that a trader were to exceed his daily trading limit. If we were to automate the exception process, it would look like this:

- Trader enters a trade into a system
- The system checks the traders daily limits
- The system then sends a message to the traders' credit manager for approval
- The credit manager approves a new intra-day limit
- The system receives the approval and processes the trade

Through the combination of a rules engine, technical workflow, and business process workflow, all of these activities can be handled electronically.

8.6 Message Monitoring / Error Handling

Although they may be physically separate components, message monitoring and error handling go hand-in-hand. Traditionally, mainframe-based systems provide a very clear status as to the order of a business transaction (i.e. process 1 successful, process 2 successful, process 3 failed.) The next iteration of programs such as ERP were all encompassing, so

there wasn't a need to track the state of different processes. However, with the trend towards using best-of-breed applications for specific functionality, there exists a need to know exactly where a transaction is and what its state is.

If a transaction were being sent from one system to another, it is generally hidden from users whether that transaction was successful or failed. Without going into various log files continuously, it might be hours or days before a problem is realized. A central monitor alleviates this issue. Designed correctly it would be able to tell the operations staff where the message was (i.e. waiting to be inserted into a database), and its state (successful, error, retry). More elaborate systems could actually provide notifications of problems (i.e. the database is down). The most sophisticated EAI systems could actually attempt to resolve issues (i.e. file system is full, therefore remove files older than 60 days).

Of course, the effort to create this type of system can be quite large. The driving question for the reader is, if you were to either lose or delay the delivery of transaction 'X', what would be the impact to your business. For some organizations, this is intolerable (i.e. trading), for others if the problem is resolved in 24 hours, this is sufficient. For the lucky few, lost data isn't important.

Depending on the functionality, the technical workflow component may be able to provide the correct level of information for your company. This should be reviewed in the context of the EAI tool and the answer to the above question.

There is an order to error handling and message monitoring functionality:

- None
- Local data logging without error codes
- Centralized logging without error codes
- Local data logging with error codes
- Centralized logging with error codes
- Centralized error notification
- Centralized error troubleshooting
- Centralized automated error handling

It is best to discuss your needs with the systems integrator to find a mix of functionality and cost which is acceptable.

8.7 System Monitoring

Message monitoring / error handling is a key component of an EAI architecture. A more traditional monitoring component is system monitoring. A system monitor traditionally notifies operations personnel as to the status of physical components such as servers, programs, routers, hubs, cards, and other physical components. There are a few widespread system monitors on the market and if your EAI vendor does not provide this functionality, it should not necessarily be the deciding factor in EAI tool choice.

For those vendors who do provide this functionality, it may not prove as robust as the tools on the market. The customer should review his requirements and determine whether

additional functionality is required. In any case, a monitoring tool is an important part of the EAI solution and an implementation should have some amount of system-monitoring functionality.

8.8 Security

By nature of moving data outside of an application, some measure of security should be evaluated. Most applications have some measure of security built in – usually requiring a user to log-in using a name and password. Systems integration, however, bypasses these security measures – providing that same data out to the middleware. Some middleware tools allow anyone to access the message – others even allow external sources to change the data. Luckily, however, most EAI companies provide some measure of security that can be activated.

Depending on need, an organization may require multiple-levels of security. The following table lists the security measure and a brief definition.

Security Level	Description
Authentication	Required to verify that a system or user is allowed to use a component (database, server). Authentication does not determine what data within that component the user/system can use.
Entitlements	Access-control lists determining whether a system/user can see a subset of data.
Encryption	Encryption of data moving between systems can be an important security measure. Encrypted users/components receive/store keys to un-encrypt data upon receipt.

Depending on how your business is to run, EAI security issues may be fixed through hardware-level security (firewalls, router encryption). Talk to your systems integrator about your requirements so the appropriate security approach can be taken.

8.9 B2B Integration Architecture

Up to this point, the EAI discussion has specifically been focused around internal integration. However, when it comes to integration outside of your physical location, perhaps across the internet, you may have a requirement for your EAI tool to support the above services (middleware, translation, workflow, monitoring, security) outside of your physical location.

This is where an EAI vendor's B2B architecture is very important. For instance, if you are creating an exchange for 1000 suppliers, do you have to purchase a copy of the EAI tool for each of those suppliers to be able to integrate with them? For most companies, the cost associated with deployment of an EAI tool to all target business is infeasible.

An EAI vendor's EAI architecture needs to support integration to target systems of an external company without forcing that company to outlay an inordinate amount of capital.

The technology should be lightweight (so as not to require additional infrastructure) and should provide functionality beyond delivery.

Many EAI vendors are in the process of developing or have available B2B architectures that support industry standards. RosettaNet partner interface protocols are a good example of the types of standards that EAI vendors should support, but this is only a starting point. In the future, look to EAI vendors to provide the full suite of EAI capability outside of the existing business firewall.

9.0 Internal vs. External Integration

The integration market is segmented into two areas-EAI and B2Bi (business-to-business integration). EAI is a solution for modeling and automating business processes within an organization by coordinating disparate data sources and applications; B2Bi is a solution for extending an organization's integration beyond its firewall to connect with external constituencies, such as partners and other supply-chain participants.

Although EAI and B2Bi may appear similar on the surface, several fundamental differences exist between them. For example, a key difference is the level of security provided; organizations integrating with their partners (B2Bi) have much more stringent security requirements than those required for internal integration (EAI)-and none of the integration servers we evaluated scored highly in this area. Another example is process management: Although this is a relatively straightforward feature for EAI, B2Bi scenarios require the ability to extend automated processes across multiple organizations and to collaborate through one-to-many and many-to-many relationships. Thus, process management usually involves participation in more diverse, less defined relationships for B2Bi than it does for EAI.

The key is to understand whether your focus is on internal or external integration, then to evaluate the products in that context. We expect the B2Bi space to become more evolved soon and for the capabilities required for external integration to find their way into existing EAI products.[6]

Many organizations have an immediate need to integrate with the external systems of their business partners and other constituencies. As such, these organizations have taken an "outside-in" approach to application integration: placing the priority on integration with external systems, while failing to address the integration issues within their own infrastructures.

In many cases, this approach has forced organizations to re-engineer their processes, as well as extend deployment time lines. This has a direct impact on budgets and increases the time to benefit. In some instances, integration initiatives fail simply because of the inability to adequately re-engineer business processes.

We recommend end users follow an "inside-out" integration strategy: First, prioritize the integration of internal systems and applications, defining and institutionalizing your business processes. Once internal integration issues have been resolved, you'll be in a far better position to integrate your infrastructure with external constituencies because this integration is then simply an extension of their current integration. During mergers and acquisitions, organizations must quickly bring together

[6] "EAI Systems Bring it Together," Network Computing, January 2002

disparate systems that suddenly fall under the same roof-before thinking about how to integrate with systems over which the organization has no control. [7]

This approach lets organizations execute their integration strategies in phases that make sense to the business and greatly helps reduce the complexity and time associated with integration strategies. While many organizations may face pressures to take an outside-in approach (to capitalize on B2B opportunities), the lack of control or understanding of these external systems can result in far greater pains in the long-run contributing to longer implementation cycles and increased cost of ownership, and further complicating the integration problem.

10.0 The Cost of EAI

Organizations looking to implement an EAI solution are faced with a hefty initial price. The average cost for products can range from $300,000 to over $1 Million, not including the cost of services (which can be two to three times the cost of the actual product). However, because integration technology lets companies leverage previous technology investments, rapidly add new technologies at a lower cost and quickly integrate the disparate systems of different companies, enterprise integration technology represents a highly strategic investment.

Although the initial cost of investing in an EAI solution may be daunting to many, the costs of integration are in fact far more extensive if you don't use EAI solutions. And prolonging the integration problem is likely to be more costly than an initial EAI investment, especially if long-term plans include a merger, acquisition or introduction of new technologies into the infrastructure.

11.0 Benefits of EAI

The major reasons organizations invest in EAI tools are as follows:

- Leverage existing investments in technology by connecting disparate systems.
- Overcome the technology barriers that prevented an alignment of business visions, goals and strategies.
- Adapt easily to changing business processes and new technologies.
- Reduce costs by automating and standardizing manual processes, sunsetting declining technologies and redundant legacy systems, reducing integration efforts and eliminating unnecessary costs such as electronic data interchange (EDI) value added network (VAN) charges.
- Improve transactions and customer service with external trading partners and exchanges.

The table below lists the benefits that should be seen from an architected approach to integration when using EAI tools

The Facts	So What?	So Where is the Benefit?
Reconfiguration of business information flows becomes faster	Business becomes more flexible and responsive to change	Reduced cost of change Business is less restricted by technology Faster time to market

[7] Ibid

The Facts	So What?	So Where is the Benefit?
Interfaces can be re-used	More efficient development practices	Reduced cost of subsequent interface deployment
Interfaces controlled with a single technology	The use of an Integration framework reduces need for obscure skills	Reduced development costs Reduced management and maintenance overheads Reduced cost of change
Better visibility of data and process	Integration hubs allow a single point of exchange for all business information	More control over business knowledge Reduce 'Silo' effect of business unit data Improved intra-business communications
Legacy systems become part of the architecture	No need for replacing systems that still offer business benefit	Reduced need for systems replacement Contemporary channels leverage legacy business rules Maintain cost effective skills and solutions
Supply chain visibility	The movement of information within the supply chain becomes manageable and controllable	Supply chain efficiencies can be introduced more easily Client order transparency
Systems become 'plug and play'	Less impact when adding or removing systems because systems only have one interface not dozens	Business change is less costly and quicker to implement New systems implementation is easier and cheaper Keep pace with beneficial technology trends Mergers and acquisitions less restricted by technology
Information becomes faster and more reliable to move	The use of an Integration framework allows information to be transferred within a managed and controlled environment	Business information is available in 'near real time' Business can act on information faster Business information can recover from systems failure
Participation in trading communities is easier and faster	Electronic trading with external organisations is not only more accessible, but also easier to manage and more cost effective	More channels for trading More efficient inter-business processes Less dependence on cost inefficient practices
Business activity monitoring (BAM) becomes easier to implement	Gives real-time view of information flows	Improved business knowledge Facilitates quick identification and response to business problems, possibilities and threats

Table 2: Benefits of EAI

12.0 Considerations in Selecting an EAI Vendor

As with any vendor acquisition, there are numerous DoD/GSA/OMB criteria used to evaluate vendors during a formal acquisition process. This section addresses the non-acquisition or product attributes the Army should consider when selecting an EAI tool. The following items in the list are the key considerations:

- Internal corporate strategy (existing tools, preferred suppliers, etc.) and how well it matches the vendor capabilities
- Is it a proven technology and solution?

- Vendor viability
- Product features
  - Usability
  - Adaptability
  - Extensibility
  - Scalability
  - Reliability
  - Manageability
  - Security

The following table (Table 3) shows additional detail and considerations for each of the product features listed above. A larger version is shown in the appendix, section 15.7.

Viability	Usability	Scalability	Adaptability	Extensibility	Reliability	Manageability	Security

• EAI solutions are enterprise infrastructures.
• Many of the EAI vendors are startups.
• Level of acceptable risk must be defined.
	• GUI EAI development environment for IT professional
	• GUI EAI development environment for business analyst
	• Traces, debuggers, and simulators
	• Templates or wizards
		• Distributed servers
		• Load balancing
		• Multi-threaded server
		• Memory-resident state and user cache
		• Connection pooling
			• Product Architecture
			• Connectivity Options
			• Support for Multiple Interaction Modes
			• Translation & Transformation
			• Business Rules and Processes
				• Business Logic
				  • Don't want to hit the wall when complex business logic is required
				• Translation & Transformation
				  • Support for different types of data formats (both input and output)
				  • Support for complex transformations
				• Adapters
				  • Support for all required applications and platforms
				  • SDK for custom solutions
					• Fail over
					• Message or object persistence
					• Transaction monitor/ state manager built-in
					• Adapter to transaction monitor
					• Compensation for long-running processes
						• Centralized management
						• End-to-end management
						• SNMP Integration
						• Process Simulation
						• Change Management and Versioning
							• SSL
							• Encryption
							• Authorization
							• Authentication
							• Non-Repudiation
							• Integrate with 3rd-party security servers

Table 3: EAI Functionality Considerations

A vendor evaluation matrix based on the above categories has been developed and is provided to assist the Army is selecting an appropriate vendor. The tool provides a mechanism to compare multiple vendors and whether they meet certain requirements.

Attached in the appendix (section 15.4) is a hard copy of the rating document. An electronic version and instructions will be located in the Army Enterprise Integration Toolkit due out in early 2004.

Also attached in section 15.5 is an electronic version of a vendor scoring tool that allows the user to weight various functional areas based on the relative importance to their organization and its use. This will be provided in the Army Enterprise Integration Toolkit as well.

Rankings of EAI vendors and how they support various COTS applications and their core functionality based on our experience and publicly available data is presented in appendix sections 15.2 and 15.3. These tables can be used as references during an acquisition; however, they are current as of October 2003 and will change as vendors release new versions of their applications.

13.0 Summary

This document provides the reader a high-level synopsis of the leading EAI tools available based on RFI responses from 23 vendors and several other leading providers if they did not respond to the RFI. The reader should not consider this the definitive answer regarding EAI use, nor should it be the sole tool used in deciding the appropriate EAI package. However, it is intended to serve as a facilitating tool to support the decision-making process.

The RFI responses (Dated no later than September 26, 2003) from the 23 vendors can be accessed through the AEIOO web page (http://www.army.mil/aeioo/).

Enterprise Application Integration (EAI) is more than middleware and integration between applications. It is integration across and among enterprises. EAI and Business-to-business integration (B2Bi) represents a growing market driven by the need for an adaptive enterprise where business processes and information flows can be altered with short notice.

EAI is a way to squeeze more efficiency from your infrastructure, while enabling more agile and flexible infrastructure to meet changing needs of the Army. EAI lets you reduce the amount of work required to keep an infrastructure running, while providing new ways to increase the return on your infrastructure investment. The result? You spend less time on low reward IT activities, making more time available for more rewarding, ambitious IT plans – or for finding ways to draw more value from your infrastructure investment. EAI provides a stable platform for legacy management, or integration with new systems. It can help increase utilization of older systems, or just provide a framework to cope with the new – and often unexpected – ways your users will try to connect the different elements of your IT infrastructure together.

The appropriate EAI technologies will allow the Army to leverage previous technology investments, add new technologies at lower costs, and integrate disparate systems. EAI creates a cost-effective integration architecture and infrastructure to promote interoperability among applications. And interoperability is the key to agility for the accelerating change that rules today's global marketplace. Custom point-to-point solutions and other e-band-aids can solve pieces of the problem in the short term, but they are typically expensive to produce and difficult to maintain.

Since integration technology represents a highly strategic investment for the Army; prolonging the integration problem can be more costly than an initial EAI investment, especially if long-term IT plans include the introduction of new technologies into the current infrastructure. Therefore, EAI technologies typically will pay for themselves quickly if you are integrating numerous systems and your IT environment is subject to frequent additions and changes.

We believe that internal (EAI) and external (B2B) integration needs could be met by the offerings of any of the five leading EAI vendors (IBM, Microsoft, SeeBeyond, Tibco, webMethods, SeeBeyond). All the leading vendors in the market provide adequate tools to address the major functional demands of an EAI solution.

Since the market is maturing, there will likely be fewer EAI vendors in the next few years, with more of the leading edge technological advances developed by the large providers (e.g. IBM and Microsoft) while capturing greater market share. How well the large ERP vendors (e.g., SAP and

Oracle) embed EAI functionality and keep them competitive remains to be seen, but could have significant impacts on the smaller vendors and the future of the EAI space from an Army perspective.

Before committing to any particular vendor, we believe that it is important for the Army to discover what existing applications, EAI tools, and integrations exist. Secondly, determine the strengths and weaknesses of those implementations given the Army and DoD requirements. Finally, given the nature of the EAI market, vendors are releasing significant upgrades to versions every 6 to 9 months, thus the Army should re-evaluate the major vendors when a procurement decision is anticipated, during the conduct of an acquisition.

14.0 References

Summary of EAI provider responses were adapted directly from their responses and various other marketing material and should be considered biased towards that vendor. Additional insight provided is derived directly from experience with the vendors and is a more unbiased review of the product as it pertains to our experience.

"Application Integration and Web Services: Understanding the New Software Infrastructure," Gartner Research, October, 2002.

"EAI Systems Bring it Together," Network Computing, January 2002

"Hype Cycle for Application Integration and Platform Middleware, 2003, " Gartner Research, May 2003

"Adaptive Infrastructure - EAI Point of View," Cap Gemini Ernst & Young, 2003

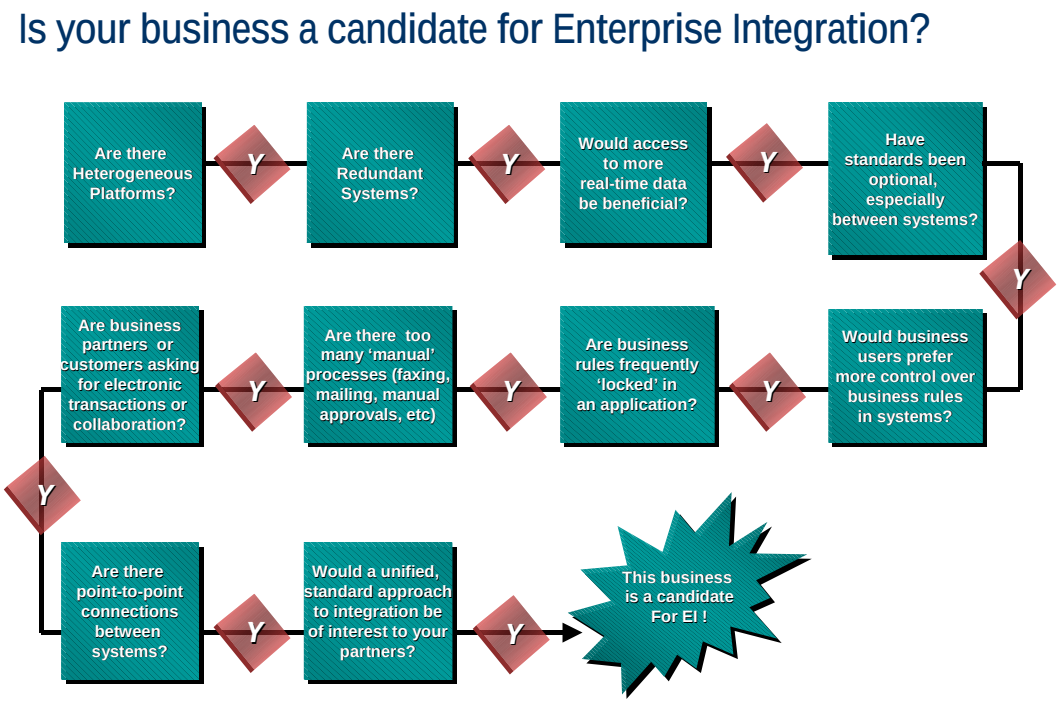
"Improving Collaboration Through Better Integration," Cap Gemini Ernst & Young, 2003

"IBM's WebSphere Integration Offer Signals Long-Term Plan" Gartner Research, April 2003

15.0 Appendix

15.1 Enterprise Integration Decision Chain

The following decision-chain is useful when determining if an organization is a candidate for Enterprise integration tools



15.2 EAI Vendors Adapter for various COTS Applications

This table reflects our view of how well the given EAI provider supports various COTS applications at the current time. As new versions of either the COTS or the EAI tools are released, this table will change. Thus, it is important for the reader of this paper to closely review all documentation and determine the impact to their program or acquisition.

	IBM	webMethods	Microsoft	Sybase	TIBCO	VITRIA
Ariba	✓✓	✓✓	✓	✓✓	✓	×	✓✓
BPCS	×	×	×	×	×	×	×
JD Edwards	✓	✓	✓	×	✓✓	✓✓	✓
PeopleSoft HR	✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓
Manugistics	✓	×	×	×	✓	✓✓	×
MFGPro	×	×	×	×	×	×	×
Oracle Applications	✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓
SAP R/3	✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓

×	No Adapter Support – Would require development
✓	3rd Party 'out of the box' adapter
✓✓	Vendor supplied 'out of the box' adapter

Source: "Adaptive Infrastructure - EAI Point of View," Cap Gemini Ernst & Young, 2003

15.3 Vendor Comparison

This chart shows how well each vendor is ranked across the various functional areas supported by the tools. An Acceptable rating is not meant to be negative; rather it is a reflection of how robust that functionality is relative to the leaders in that area. As with the previous chart (section 15.2), it is important for the reader to understand the enhancements to the tool as new versions are released. Typically, the shortcomings as listed here (Acceptable) are addressed with a new version.

	IBM WSI	webMethods 6.01	Microsoft 2004	5	8.1	TIBCO	VITRIA 4.1
Functional capabilities and characteristics	✓✓	✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓
Flexibility, ease of response to change in integrated applications over time	✓	✓✓✓	✓✓✓	✓✓	✓✓	✓✓	✓✓
Support for standards and security (Rosetta, OAG, BPEL, EDI, WSL, etc)	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓	✓	✓✓
Simplicity or complexity of tools for transformation (mapping, transformations)	✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓
How extensible via traditional programming	✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓	✓✓✓
Support for Business Process Management	✓	✓✓	✓✓✓	✓✓	✓✓✓	✓✓	✓✓✓
Development tools (how well integrated)	✓	✓✓	✓✓✓	✓✓✓	✓✓	✓✓	✓✓✓
Availability/ease in using adapters	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓	✓✓	✓✓
Legacy integration capability, including access mainframe	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓	✓✓	✓✓
Support for heterogeneous messaging infrastructure (MQ, JMS, MSMQ, other)	✓✓	✓✓	✓✓	✓✓	✓✓✓	✓	✓✓✓
Configuration management/migration	✓✓	✓	✓✓✓	✓✓	✓✓✓	✓	✓✓✓
Support for exception handling / workflow	✓✓	✓✓	✓✓✓	✓✓	✓	✓✓	✓✓
Administration (operations) and Monitoring capabilities	✓✓	✓✓✓	✓✓	✓✓	✓✓	✓✓	✓✓

✓	**Acceptable**
✓✓	**Good**
✓✓✓	**Excellent**

Source: "Adaptive Infrastructure - EAI Point of View," Cap Gemini Ernst & Young, 2003

15.4 EAI Vendor Evaluation Template

Product Description	Yes	No	Explain / Describe
Basic Architecture – supported standards			
The product supports industry standards (e.g., EJB, CORBA, XML, UML, IIOP, etc.).			
The product provides an architecture that is:			
- Database independent			
- Hardware independent			
- Operating system independent			
- Presentation independent			
The product supports scaleable naming/directory service (e.g. CORBA Naming, LDAP, etc.).			
The product supports a repository for all metadata management including interface definitions, event definitions, object definitions, transformation maps, configuration information, etc.			
Basic Architecture – supported protocols, languages and platforms			
What underlying network protocols does the product support?			
What method, language and / or tools are used in the design and development of the product?			
For which architecture and operating system was the product developed initially?			
Has the product been ported to other hardware and systems? If Yes, specify:			
On which system is the product currently native?			
Which operating system and platform is considered the strategic platform for the product? What is the release schedule in general for all the different platforms supported by this product? (For example, first developed in NT, ported to AIX 6 months later).			
Describe hardware architecture that supports the package.			
Is the product developed as a single solution, or is it a suite of add-on products?			
Is the product bundled with other products or architectures? If yes, are their interfaces open-system based?			
Do they share the same database?			
Do they have a uniform user interface?			
Can each product be accessed from a common menu?			
Basic Architecture – Scalability			
The product's architecture allows incremental addition of resources including servers, disks, network elements, etc. as well as application components.			
The product supports a multithreaded, multiprocessing architecture that effectively uses system/network resources.			
The product supports geographically dispersed locations (i.e., for reliability, latency, etc.).			
The product supports load balancing and/or partitioning of key			

resources.			
The product supports adding & removing components dynamically without impacting other components.			
The product supports arbitrary numbers of publishers, subscribers, connections, and other participants that can be supported in a linearly scaling of the system.			
Based on the Transaction Processing largest customers regarding this product, what is:			
- Number of peak concurrent users?			
- Peak transaction rate?			
- Max Active users logged on?			
- Max Data transfer capacity?			
- Max Number of concurrent sites / servers?			
Are there any other constraints on the usage of the product:			
- Maximum storage capacity?			
- Number of fields?			
- Maximum field length?			
- Maximum number of messages and or message length?			
- Others?			
Describe available utilities to measure the performance of this product.			
Describe used performance bench mark, if any, for the following areas:			
- Message processing			
- Event processing			
- Database access			
- Application logic processing			
- Load balancing			
- Transaction processing			
Basic Architecture – Availability			
The product supports fault tolerance and elimination of single points of failure.			
The product supports fail-over (e.g. loss of a resource results in no data loss with minimal down time, for ex. clustering techniques).			
The product supports protection of data (e.g. RAID disk, separation of logs from data, etc.).			
The product supports distribution to allow diverse paths of access and dispersed location of services.			
Basic Architecture – Disaster Recovery			
The product supports allowing components to fail and return without any requirement to reinitialize other components			
Are backups accomplished in a 24x7 environment within your product?			
Basic Architecture – Security Integration			
What is the overall security scheme & methodology?			

Does the product support authentication and encryption protocols, including public and private key?			
Does the product give means for providing configurable access control to all integration infrastructure components?			
Does the product give supports for individual security settings based on the type of information, the source of information, and the identity of the requesting party.			
How the product prevents unauthorized modification of the information exchange models, exchange configurations, installation of components, and all other elements that affect the infrastructure implementation.			
What are the levels (granularity) of security:			
- Data specific?			
- User specific?			
- System specific?			
- Object specific?			
- Process specific?			
- Time / place specific?			
Connectivity (Adapters)			
Describe how the product supports off-the-shelf "packaged" connectivity, including that for files, relational database systems, and message queuing systems. Specifically, which are the available connectors supported (especially for ERP / Legacy systems with special focus: SAP)			
The product supports the use of CORBA IDL to specify interfaces to applications.			
IDE			
Does the product support an integrated Visual IDE to develop new Adapters?			
Persistence			
The product supports persistence service, based on standard APIs.			
Delivery			
The product supports a publish/subscribe communications model.			
The product supports a hub and spoke comm. model.			
The product supports a request/reply comm. model.			
The product supports multiple communication models.			
The product supports synchronous messaging.			
The product supports asynchronous messaging (queue-based).			
The product supports multiple Quality-of-Service (QoS) and priority levels allowing fine-grained optimization of both reliability and efficiencies.			
The product supports a transactional QoS level to ensure delivery of messages exactly once, despite network or server disruptions or failures.			
The product supports message retention policies (e.g. time-to-live, number of messages, etc.).			
The product supports content based filtering.			
The product support interoperability of messaging technologies, if			

applicable.			
The product supports utilizing new (e.g. event) and stored data (e.g. relational database) for the purpose of supporting both manual and automated decision-making, including the automated routing of events from sources to destinations.			
The product supports a generalized query language to retrieve data for such analysis, supporting simple to sophisticated analysis of new and stored data.			
Data Transformation			
The product supports complex any-to-any data transformation to / from one to another system data representation.			
The product supports transformation to / from EDI standard forms.			
The product supports off the shelf data transformation? Among which formats?			
The product supports the ability to perform custom transformations, which can be performed whenever they are not included with the standard transformation functions in the base product (e.g. hand-coded in Java).			
The product supports XML, DTD, XML Schemas and XSLT.			
Workflow			
The product supports modeling business processes, preferably using a high-level tool utilizing a standard language.			
The product supports simple to sophisticated business processes, including those best-modeled collections of sub-processes, and allowing nested and concurrent executions.			
The product supports coexistence of different versions of business processes and services.			
The product supports end-to-end state management (e.g. a situation where it is necessary to maintain the state in the integration infrastructure of an object that has a representation in one or more applications).			
The product supports distributed transactions, including recovery, multi-phase commits, and rollbacks.			
The product supports notification of significant state changes and exceptions via event and email as modeled by the user.			
The product supports audit traces of all activities.			
The product can coordinate super-transactions that span multiple applications (such as a long workflow transaction containing multiple application-to-application transactions that execute in the context of a super-transaction).			
B2B Transaction Support			
The product supports transactions with trading exchanges via XML over http protocol (Web) to trading partners.			
The product supports business transactions via EDI using Value Added Networks. Which VANs are supported?			
The product supports EDI over the Internet.			
The product could support processes incorporating simultaneous EDI and XML exchanges with multiple trading partners.			
Messaging Monitoring			
The product can support an event history facility to allow system administration to automatically log all or selective information exchanges in a relational database. The database shall be available for querying and reporting using standard tools. Mechanisms shall be provided so that administration can control			

the volume of flow into the history and volume retained in the history within available capacity of resources.			
How the event history records the time at which the source issued each event, and the time at which each registrant received the event (common clock?).			
Can the state of public data (i.e. the data handled by the infrastructure) be recreated from the event history for any point in time (provided that logging has not been disabled by the system administrator)?			
System Management – general			
The product supports local and remote visibility of all integration infrastructure components.			
Does the product support common GUI-based administration for managing all integration infrastructure components?			
Does the product support real-time monitoring and reporting of all vital and performance statistics?			
Does the product support coexistence of different versions of infrastructure components?			
Does the product support coexistence of development, testing, and production environments?			
Which type of transport mechanism is in place to align development, test and production environment?			
Does the product support prior versions?			
Does the product have capabilities to the logging and audit trails all system activities, including configuration and operation?			
How does the product provide the ability to make configuration changes:			
- Customize edits through the use of code/validation tables?			
- Turn features on/off via parameters?			
- Tailor the product to a specific user of the product (i.e. developers, tester, etc…) through profiling?			
How does the product support revision control where:			
- Is It quick easy to keep local changes when moving to a new release?			
- Is each revision compatible with future releases?			
Does the product provide restricted access by users for:			
- Application?			
- Function?			
- Screen?			
- Data?			
- Location-sensitive access?			
- Remote access?			
Does the product provide customization capabilities to:			
- Modify screen formats easily?			
- Build custom screens?			
- User exit macros (hooks to local modifications) with no modification to standard code?			
Does the product provide extensive online help?			

System Management - Support / Maintenance/Training			
Describe the method for delivering software:			
- General Upgrades?			
- Frequent Bug fixes?			
Are there committed response to providing fixes to bug / defect problems (Service Levels)			
How is maintenance services supplied?			
Which are the restrictions on the use of source code?			
Is a maintenance contract optional or automatic to user licenses?			
Describe what is included in the maintenance contract. Cover the following items:			
- Free delivery of new releases			
- Upgrades			
- Training for new releases			
- 7x24 telephone support			
- support service available through an 800 number			
- a guaranteed turnaround time for trouble calls?			
- a maximum delay period for calls			
- onsite assistance			
- free or cost-based phone support service			
- Technician call cost and travel expenses			
- Documentation updates			
- User group participation			
- Remote program maintenance			
- Access to an interactive server (i.e. Internet or videotex system) that lists bugs identified by users and the vendor's responses			
Is standardized training provided:			
- At a training center or ion-site?			
- Provide training course overviews and duration.			
Describe all product documentation.			
How many copies of manuals and other documentation are supplied with the product?			
Is it possible to purchase additional copies of the documentation materials? May our organization copy documentation for internal use?			
What is the documentation update process and frequency, and is documentation update:			
Sent automatically?			
Supplied if specified in contract once new release is available?			
Included as part of the contract?			
Included as part of the product maintenance agreement?			
Describe the medium used for each category of documentation (e.g., paper, online, CD ROM, Web)			

15.5 EAI Tool Scoring Matrix

The file link below is another scoring system for EAI tools that compares up to five vendors at one time based on the weighting that the user selects.

"EAI Tool Scoring Matrix.xls"

15.6 Acronyms

- A2A – Application to Application
- AEIOO – Army Enterprise Integration Oversight Office
- ASP – Application Service Providers
- B2B – Business-to-Business
- B2Bi – Business-to-Business Integration
- BPI – Business Process Integration
- COTS – Commercial off-the-shelf (refers to commercially software vs. custom development)
- CRM- Customer Relationship Management
- EAI – Enterprise Application Integration
- EDI – Electronic Data Interchange
- ERP – Enterprise Resource Planning
- ESA – Enterprise Services Architecture
- IBM – International Business Machines
- IERs- Information Exchange Requirements
- IT – Information Technology
- J2EE – Java 2 Platform, Enterprise Edition
- OAI – Oracle Applications Interconnect
- OLTP – Online transaction processing
- POS – Point of Sale
- R&T – Rules and Transformation
- RFI – Request for Information
- ROI – Return on Investment
- SCM- Supply Chain Management
- SRM – Supplier Relationship Management
- SAP – Systems Application Processes – German ERP Software Provider
- UAN - Universal Application Network
- WBI – WebSphere Business Integration
- XML – Extensible Markup Language

15.7 EAI Functionality Considerations

Viability	Usability	Scalability	Adaptability	Extensibility	Reliability	Manageability	Security

• EAI solutions are enterprise infrastructures.
• Many of the EAI vendors are startups.
• Level of acceptable risk must be defined.
	• GUI EAI development environment for IT professional
	• GUI EAI development environment for business analyst
	• Traces, debuggers, and simulators
	• Templates or wizards
		• Distributed servers
		• Load balancing
		• Multi-threaded server
		• Memory-resident state and user cache
		• Connection pooling
			• Product Architecture
			• Connectivity Options
			• Support for Multiple Interaction Modes
			• Translation & Transformation
			• Business Rules and Processes
				• Business Logic
				  • Don't want to hit the wall when complex business logic is required
				• Translation & Transformation
				  • Support for different types of data formats (both input and output)
				  • Support for complex transformations
				• Adapters
				  • Support for all required applications and platforms
				  • SDK for custom solutions
					• Fail over
					• Message or object persistence
					• Transaction monitor/ state manager built-in
					• Adapter to transaction monitor
					• Compensation for long-running processes
						• Centralized management
						• End-to-end management
						• SNMP Integration
						• Process Simulation
						• Change Management and Versioning
							• SSL
							• Encryption
							• Authorization
							• Authentication
							• Non-Repudiation
							• Integrate with 3rd-party security servers